

IN THE CLAIMS

Please amend Claims 11-15 to read as follows.

Sub B1

1. (Withdrawn) A liquid discharge head, comprising:

a discharge port to discharge a liquid;

a liquid flow path communicating with said discharge port and having a bubble generating region to let the liquid generate a bubble;

a discharge energy generating device, installed in a substrate, to generate thermal energy to let the liquid generate the bubble in said bubble generating region; and

a plate-like movable member located in an position opposite to said discharge energy generating device with a distance from said discharge energy generating device, fixed an end part of an upstream side thereof in a direction of a flow of the liquid in said liquid flow path and made the end of a downstream thereof free, and formed on said substrate by film formation, wherein the side part of said movable member has no right angle or no acute angle.

2. (Withdrawn) A liquid discharge head, comprising:

a discharge port to discharge the liquid;

a liquid flow path communicating with said discharge port and having a bubble generating region to let the liquid generate the bubble;

a discharge energy generating device, installed in a substrate, to generate thermal energy to let the liquid generate the bubble in said bubble generating region; and

a plate-like movable member located in a position opposite to said discharge energy generating device with a distance from said discharge energy generating device, fixed an end part of an upstream side thereof in a direction of a flow of a liquid in said liquid flow path and made the end of a downstream thereof free, and formed on said substrate by film formation, wherein an edge of the side part of said movable member has a curved face.

3. (Withdrawn) A liquid discharge head, comprising:

62 a discharge port to discharge a liquid;

a liquid flow path communicating with said discharge port and having a bubble generating region to let the liquid generate a bubble;

a discharge energy generating device, installed in a substrate, to generate thermal energy to let the liquid generate the bubble in said bubble generating region; and

a plate-like movable member located in a position opposite to said discharge energy generating device with the distance from said discharge energy generating device, fixed an end part of an upstream side thereof in a direction of a flow of a liquid in said liquid flow path and made the end of a downstream thereof free, and formed on said substrate by film formation, wherein the edge of the side part of said movable member is chamfered.

4. (Withdrawn) The liquid discharge head according to claim 1 or 3, wherein said movable member is one formed by photolithographic technique on a device substrate on which said discharge energy generating device is installed.

5. (Withdrawn) A liquid discharge head, comprising:

a discharge port to discharge the liquid;

a liquid flow path communicating with said discharge port and having a bubble generating region to let the liquid generate a bubble;

a discharge energy generating device, installed in the substrate, to generate thermal energy to let the liquid generate the bubble in said bubble generating region; and

a plate-like movable member located in a position opposite to said discharge energy generating device with a distance from said discharge energy generating device, fixed an end part of an upstream side thereof in a direction of a flow of the liquid in said liquid flow path and made the end of the downstream thereof free, and formed on said substrate by film formation,

wherein on a surface of said substrate, a plurality of electrode layers, that is extended to at least a part of a region and a part around the region corresponding to a plurality of said movable member and is electrically connected to said discharge energy generating device, are formed; and

in comparison with a width in a direction right-angled to the direction of a liquid flow in said liquid flow path in all of said electrode layers, the width in the direction right-angled to the direction of a liquid flow in said liquid flow path and in parallel to a surface of said device substrate in said movable member becomes small.

6. (Withdrawn) The liquid discharge head according to claim 1, wherein a constituting material of said movable member is a ceramic.

7. (Withdrawn) The liquid discharge head according to claim 1, wherein a constituting material of said movable member is silicon nitride.

8. (Withdrawn) A liquid discharge apparatus comprising: a liquid discharge head according to claim 1 and actuation signal supply means for supplying an actuation signal for discharge of the liquid from the liquid discharge head.

9. (Withdrawn) A liquid discharge apparatus comprising: a liquid discharge head according to claim 1 and recording-medium carrying means for carrying a recording medium to receive the liquid discharged from the liquid discharge head.

10. (Withdrawn) The liquid discharge apparatus according to claim 8 or 9, recording through discharging ink from said liquid discharge head and attaching the ink to the recording medium.

11. (Currently Amended) A method of manufacturing a liquid discharge head, ~~comprising: the liquid discharge head comprising~~ a device substrate, ~~a plurality of discharge energy generating devices to generate thermal energy to let the liquids generate a bubble, being provided in parallel on a surface thereof; a plurality of liquid flow paths, in each of which each of said discharge energy generating devices is arranged; path~~ having a bubble generating region to let the liquid generate a bubble; for generating a bubble in liquid therein, a discharge energy generating device provided on the device substrate and arranged in the liquid flow path to

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generate thermal energy for generating the bubble in the liquid, a plurality of discharge ports port
to discharge the liquid in the liquid flow path, each of the discharge ports port communicating
with each of said the liquid flow paths; a flow path wall member mounted on said device
substrate to form said plurality of liquid flow paths; path, and a plurality of plate-like movable
members, which are member mounted on said the device substrate to face each of said plurality
of the discharge energy generating devices device with an interval with respect to each said the
discharge energy generating devices and an end part of an upstream side device, the movable
member being plate-like) and having a fixed end part in an upstream side of the movable member
in the direction of the liquid flow in said the liquid flow path is fixed and a downstream end is a
free end; free end at a downstream end of the movable member, said method comprising the
steps of:

wherein the method, of manufacturing the liquid discharge head, comprises a
post-treatment step of removing a right-angled part projecting to make a distal end right-angled
in an edge part of a side part of said movable member and an acute-angled part projecting to
make the distal end acute-angled in the edge after a plurality of movable members are formed on
said device substrate by photolithographic technique

forming the movable member on the device substrate by a photolithographic
technique; and

removing a right-angled part and an acute-angled part of an edge of the movable
member.

12. (Currently Amended) The method of manufacturing a liquid discharge head, head according to claim 11, wherein in said ~~post-treatment removing~~ step, ~~the edge of the side part of said movable member is processed to make the edge to curved one~~ a curved surface is formed on the edge of the movable member.

13. (Currently Amended) The method of manufacturing a liquid discharge head, head according to claim 11, wherein in said ~~post-treatment removing~~ step, the edge of the side part of said movable member is ~~processed to make the edge to~~ made chamfered one.

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14. (Currently Amended) The method of manufacturing a liquid discharge head, head according to claim 11, wherein said ~~post-treatment removing~~ step is a step of comprises soaking ~~said the~~ movable member in an etching solution.

15. (Currently Amended) The method of manufacturing a liquid discharge head, head according to claim 11, wherein said ~~post-treatment removing~~ step is a step of ~~processing said edge by~~ comprises radiating a laser light on the edge of the ~~edge of the side part of said movable member.~~

16. (Withdrawn) A method of manufacturing a liquid discharge head, comprising:

a device substrate, a plurality of discharge energy generating devices to generate thermal energy to let the liquids generate the bubble, being provided in parallel on a surface thereof;

a plurality of liquid flow paths, in each of which each of said discharge energy generating devices is arranged, having the bubble generating region to let the liquid generate the bubble;

a plurality of discharge ports to discharge the liquid in the liquid flow path, each of the discharge ports communicating with each of said liquid flow paths;

a flow path wall member mounted on said device substrate to form a plurality of said liquid flow path; and

a plurality of plate-like movable members, which are mounted on said device substrate to face each of said plurality of discharge energy generating devices with an interval with respect to each of said discharge energy generating devices and an end part of an upstream side in the direction of the liquid flow in said liquid flow path is fixed and the downstream end is the free end;

a ceiling board, that is adhered to a face of a side opposite to said device substrate side, of a plurality of said side wall of the flow path,

in which on the surface of said device substrate, a plurality of electrode layers, which are extended to at least the part of the region and the part around the region corresponding to said plurality of movable members and each of which is electrically connected to said discharge energy generating device, are formed, comprising the steps of:

preparing said device substrate in which said plurality of discharge energy generating devices are mounted on the surface of said device substrate and a plurality of electrode layers;

forming a pattern member, corresponding to a space of said bubble generating region, on the surface of said device substrate;

layering a first material layer for forming said movable member to cover said pattern member;

layering an etching-resistant protection film, having etching-resistant property against said first material layer, on the surface of said first material layer;

patterning said etching-resistant protection film to make said movable member of which angle is right-angled to the direction of the liquid flow in said liquid flow path and width is small in a shape in parallel to the surface of said device substrate in said movable member;

layering a second material layer for forming said side wall of the flow path to cover said etching-resistant protection film patterned;

removing the part, corresponding to said liquid flow path, of said second material layer by etching and forming said side wall of the flow path and said liquid flow path; and

removing said pattern member after the step for forming said liquid flow path and forming said movable member.

17. (Withdrawn) The method of manufacturing a liquid discharge head according to claim 11, wherein silicon nitride is used as the material of said movable member.

18. (Withdrawn) The method of manufacturing a liquid discharge head according to claim 16, wherein silicon nitride is used as the material of said movable member, PSG is used as the material of said pattern member, and aluminum is used as the material of said etching-resistant protection film.

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